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MONTHLY WEIGHT AND BALANCE REPORT

FOR THE APOLLO SPACECRAFT

CONTRACT NAS 9-150

(U)

Paragraph 5.1, Exhibit I

1 February 1964

Prepared by

Weight Control

[redacted]

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CLASSIFICATION CHANGE

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SPACE and INFORMATION SYSTEMS DIVISION

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INTRODUCTION

The February report is the third report utilizing the current Airframe 011 drawing release as a basis. The current weight status summarizes the change from the previous Airframe 011 weight, and incorporates the estimated changes for the LOR Mission Spacecraft. This format allows weight status reporting consistent with airframe release and continuous updating of the estimated LOR changes.

The current report reflects a LOR spacecraft increase of 440 pounds at injection and 185 pounds at injected spacecraft condition less Service Module propellant. The current injected weight of 85,680 pounds is based on Service Module loaded with sufficient propellant at a specific impulse of 313.0 to provide 10 per cent $\triangle$ V margin. This is based on a LEM weight, including crew, of 25,000 pounds.

The major changes in the Command Module were due to increases in the crew couch structure and couch attenuation, an increase in wiring and connectors based on calculation of Airframe 011 wiring lists and the addition of crushable energy absorbing structure in the aft equipment bay in the impact area.

The major change in the Service Module was due to a reduction in wiring for the LOR Mission based on refinement of wiring insulation and wiring gages.

The major change in the Launch Escape System was due to an increase in ballast consistent with the combined Launch Escape and Command Module balance requirements.

The Earth Orbital Mission Weight Summary reflects a two stage Booster-to-Orbit injection without the use of Service Module propulsion and is based on a complete Service Module loaded with 2425 pounds of deorbit propellant. The Earth Orbit weight reported limits the orbital altitude capability with the Saturn I booster to 72.3 nautical miles. To obtain the 100 nautical mile orbital altitude with the Saturn I booster requires off loading items from the Command Module and Service Module.

APOLLO LOR MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT.^{2})		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9990	1043.7	0.0	7.2	4591	4150	3859
SERVICE MODULE - Less Propellant	9895	908.1	0.2	-0.1	6326	10542	10362
TOTAL - Less Propellant	19885	976.2	0.1	3.6	10974	34478	33950
PROPELLANT - S/M**	37935	906.4	5.1	-2.1	19553	20146	26828
TOTAL - With Propellant	57820	930.4	3.4	-0.2	30688	68444	74577
LUNAR EXCURSION MODULE	24460	623.0	-0.1	1.4	13616	12776	13247
ADAPTER - LEM - C-5	3400	642.7	0.0	0.0	8370	12271	12271
TOTAL - Injected	85680	831.2	2.3	0.3	52732	471273	477917
LAUNCH ESCAPE SYSTEM	7260	1295.2	0.0	-0.3	288	12663	12666
TOTAL - SPACECRAFT LAUNCH	92940	867.5	2.1	0.3	53028	794908	801562

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

**The propellant weight of 37935 pounds provides approximately 10% ΔV margin, and is determined from an estimated time line analysis. The propellant weight is based on a specific impulse of 313.0.

APOLLO EARTH ORBIT MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT.^{2})		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9990	1043.7	0.0	7.2	4591	4150	3859
SERVICE MODULE - Less Propellant	9895	908.1	0.2	-0.1	6326	10542	10362
TOTAL - Less Propellant	19885	976.2	0.1	3.6	10974	34478	33950
PROPELLANT - S/M**	2425	849.0	27.3	-11.5	815	444	564
TOTAL - With Propellant	22310	962.4	3.1	1.9	12240	42579	42410
ADAPTER - C-1	885	778.5	-0.3	-0.5	1058	868	820
TOTAL - Injected	23195	955.4	2.9	1.8	13301	49662	49446
LAUNCH ESCAPE SYSTEM	7260	1295.2	0.0	-0.3	288	12663	12666
TOTAL - Spacecraft Launch	30455	1036.4	2.2	1.3	13605	200150	199942

NOTES: *Centers of gravity are in the NASA reference system except that the longitidinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

**The earth orbital weights are based on a complete service module and includes 2425 pounds of propellant for an orbital altitude of about 72.3 nautical miles with a payload launch azimuth of 72°.

APOLLO LAUNCH ABORT CONFIGURATION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT.^{2})		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9990	1043.7	0.0	7.2	4591	4150	3859
LAUNCH ESCAPE SYSTEM	7260	1295.2	0.0	-0.3	288	12663	12666
TOTAL - Launch Abort	17250	1149.5	0.0	4.0	4930	74266	73927
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3205	1296.2	0.0	0.0	-69	-1299	-1299
TOTAL - LES Burnout	14045	1116.1	0.0	5.0	4847	54681	54355

NOTE: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LUNAR ORBIT RENDEZVOUS MISSION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Izy
COMMAND MODULE, LAUNCH	9990	1043.7	0.0	7.2	4591	4150	3859	-8	-238	-28
ADJUSTMENTS (NET) Boost & Mission Coolants Food & Water Consumption Mission Waste Pickup Fuel Cell Water Pickup Docking Provisions Ablator B/O, Boost	-71									
PRIOR TO ENTRY	9919	1042.7	0.0	7.4	4582	4067	3769	6	-249	-21
Less: Propellant	-135	1022.6	-5.1	56.6						
Ablator Burnoff	-240	1024.4	0.0	12.5						
Entry Coolant	-6	1022.6	-63.4	-16.4						
Forward Heat Shield	-336	1098.3	-0.1	3.4						
Drogue Chutes	-50	1090.0	0.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9152	1041.2	0.2	6.9	4238	3531	3293	2	-186	-16
Less: Main Chutes (3)	-461	1089.9	0.3	6.7						
Propellant	-135	1022.6	-5.1	56.6						
LANDING	8556	1038.8	0.2	6.1	4088	3179	2971	-1	-162	-8

NOTE: Mass inertia data is shown for accumulative totals only.

COMMAND MODULE + LEV

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

HIGH ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY*			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
COMMAND MODULE	9990	1043.7	0.0	7.2	4591	4150	3859	-8	-238	-28
Boost Cover	175	1100.7	0.0	0.0						
LEV Tower	577	1141.1	0.0	-2.4						
C/M, TOWER & COVER	10742	1049.9	0.0	6.6	4718	5607	5306	-8	-361	-28
Less: Boost Coolant	-4	1022.6	-63.4	-16.4						
Tower Insulation B/O	-104	1142.0	0.0	0.0						
Ablator Burnoff, Boost	-54	1032.8	0.0	10.9						
C/M, ABORT PHASE	10580	1049.1	0.0	6.6	4641	5347	5043	-9	-347	-29
Less: Propellant	-135	1022.6	-5.1	56.6						
Entry Coolant	-6	1022.6	-63.4	-16.4						
LEV Tower (A_t B/O)	-473	1140.9	0.0	-2.9						
Boost Cover	-175	1100.7	0.0	0.0						
Forward Heat Shield	-336	1098.3	-0.1	3.4						
Docking Provisions	-100	1110.3	0.0	0.0						
Drogue Chutes	-50	1090.0	0.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9305	1041.2	0.1	6.9	4348	3634	3394	-13	-170	-24
Less: Main Chutes (3)	-461	1089.9	0.3	6.7						
Propellant	-135	1022.6	-5.1	56.6						
LANDING	8709	1038.9	0.2	6.1	4199	3282	3072	-16	-146	-16

NOTE: Mass inertia data is shown for accumulative totals only.

COMMAND MODULE

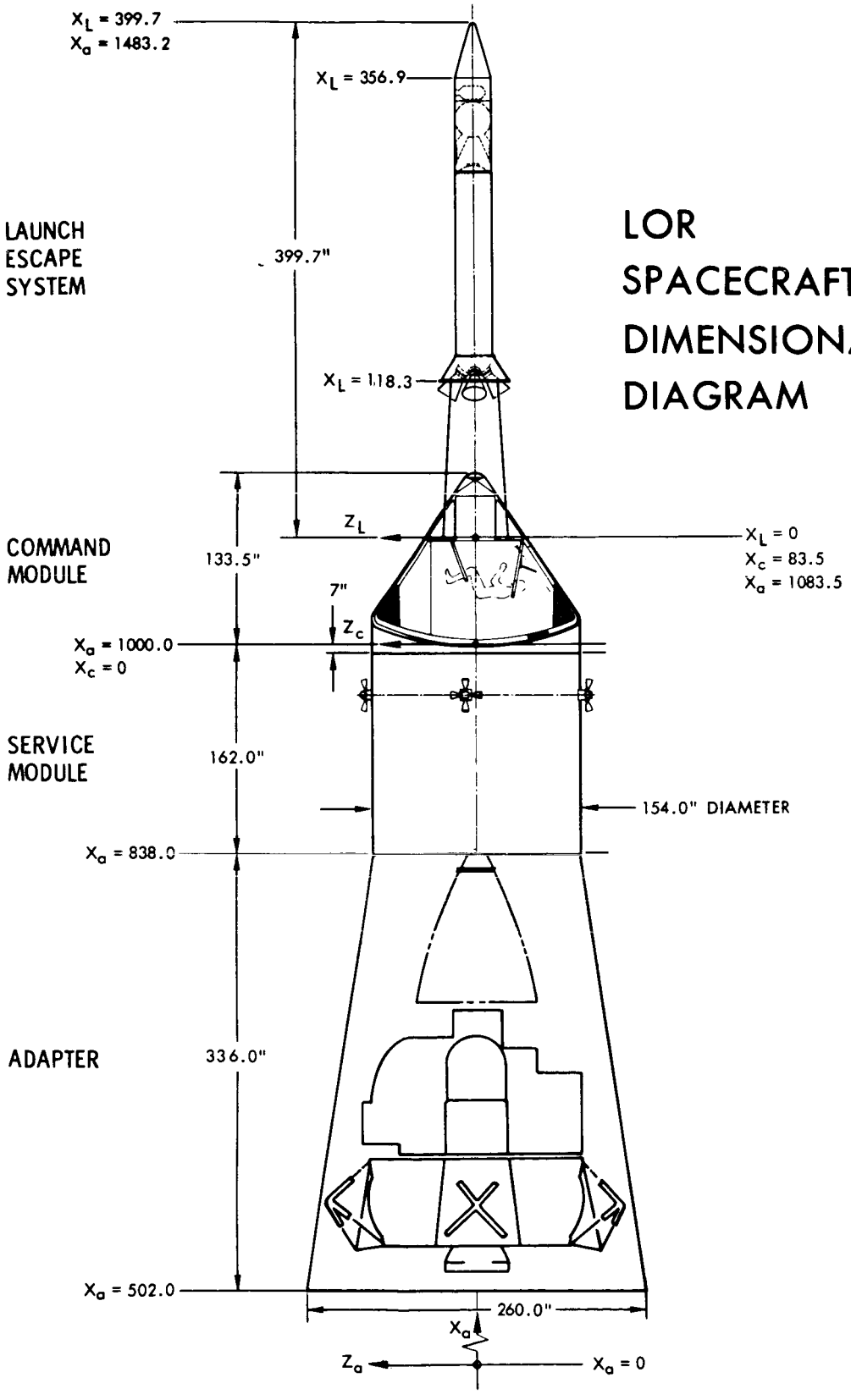
WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LOW ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT.^{2})					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Izy
COMMAND MODULE, LAUNCH	9990	1043.7	0.0	7.2	4591	4150	3859	-8	-238	-28
Less: Oxident	-180	1022.6	15.6	62.4						
Forward Heat Shield	-336	1098.3	-0.1	3.4						
Docking Provisions	-100	1110.0	0.0	0.0						
Drogue Chute	-50	1090.0	0.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9324	1041.2	-0.3	6.5	4377	3613	3435	4	-156	-60
Less: Main Chutes (3)	-461	1089.9	0.3	6.7						
Fuel	-90	1022.6	-46.5	44.9						
LANDING	8773	1038.8	0.1	6.1	4255	3309	3099	-14	-145	-27

NOTE: Mass inertia data is shown for accumulative totals only.

LOR SPACECRAFT DIMENSIONAL DIAGRAM



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SPACECRAFT

WEIGHT STATUS SUMMARY

(LESS LEM)

ITEM	PREVIOUS AFRM 011 STATUS 1-1-64	CHANGE TO CURRENT AFRM	CURRENT AFRM 011 WEIGHT 2-1-64	ESTIMATED CHANGES TO LOR	CURRENT LOR WEIGHT 2-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
COMMAND MODULE	9940	+345	10285	-295	9990	40	60	
SERVICE MODULE - B/O	9750	+55	9805	+90	9895	19	71	10
LES	7095	+70	7165	+95	7260	41	50	9
ADAPTER	885		885	+2515	3400	100		
TOTAL LESS PROPELLANT	27670	+470	28140	+2405	30545	40	55	5
LOR PROPELLANT	-	-	-	-	37935		100	
GROSS WEIGHT	-	-	-	-	68480	18	80	2

INJECTED SPACECRAFT

WEIGHT STATUS

ITEM	PREVIOUS LOR STATUS 1-1-64	CHANGE TO CURRENT	CURRENT LOR STATUS 2-1-64
COMMAND MODULE	9790	+200	9990
SERVICE MODULE	9910	-15	9895
ADAPTER	3400		3400
LEM	24460		24460
TOTAL S/C Injected Less Propellant	47560	+185	47745
PROPELLANT	37680	+255	37935
TOTAL INJECTED WEIGHT	85240	+440	85680

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COMMAND MODULE WEIGHT STATUS

ITEM	PREVIOUS AFRM 011 STATUS 1-1-64	CHANGE TO CURRENT AFRM	CURRENT AFRM 011 WEIGHT 2-1-64	ESTIMATED CHANGES TO LOR	CURRENT LOR WEIGHT 2-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
Structure	(4747)	(+4)	(4751)	(-71)	(4680)			
Structure - Less Ablator	3394	+4	3398	+9	3407	15	85	
Ablation Material	1353		1353	-80	1273	100		
Crew Systems	298	+89	387		387	19	81	
Communications	409	-48	361	-9	352	33	67	
Instrumentation	481	+188	669	-413	256	63	37	
Controls and Displays	285	+42	327	-27	300	32	68	
Guidance and Navigation	422	+19	441	-10	431	76	24	
Stabilization and Control	214	+39	253	-26	227	14	86	
Reaction Control	327		327		327	85	15	
Electrical Power	499	+34	533	-14	519	83	17	
Environmental Control	297	-9	288	-7	281	27	73	
Earth Landing	656	+36	692		692	10	87	3
WEIGHT EMPTY	8635	+394	9029	-577	8452	41	59	
Crew (3), (50, 70, 90 percentile)	528		528		528		100	
Crew System Equipment	270	-43	227	+33	260	100		
Food and Containers	80		80		80	100		
Reaction Control Propellant	270		270		270		100	
Environmental Control Chemicals	157	-6	151	- 1	150		100	
Scientific Payload				+250	250	100		
GROSS WEIGHT	9940	+345	10285	-295	9990	40	60	

COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

STRUCTURE	(+4.0)
Increase inner structure honeycomb panels due to increased umbilical requirements.	+2.0
Decrease inner structure fittings and attachments due to a reduction in attaching tees required by the addition of crushable honeycomb.	-1.0
Increase secondary structure due to calculation of released drawings reflecting additional parts not shown on pre-released drawings.	+5.0
Increase heat shield substructure center section honeycomb panels due to increased umbilical requirements.	+3.0
Decrease heat shield substructure center section due to deleting trusses and frames not required with addition of crushable honeycomb for the tumbling concept.	-5.0
CREW SYSTEMS	(+89.0)
Increase crew couch structure based on calculation of released drawings reflecting higher loads created by the removal of earth landing system impact attenuation.	+67.0
Increase crew couch attenuation due to calculation of released drawings of current design based on higher loads created by the removal of earth landing system impact attenuation.	+22.0
COMMUNICATIONS	(-48.0)
Decrease data distribution panel based on calculation of released drawings.	-2.5
Decrease Communication electrical wiring and connectors based on current measurement requirements reflected on released wiring diagrams.	-45.5

[redacted]

COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

INSTRUMENTATION	(+188.0)
Decrease data distribution panel based on calculation of released drawings.	-2.0
Increase Instrumentation wiring and connectors based on current measurements requirements reflected on release wiring diagrams.	+190.0
CONTROLS AND DISPLAYS	(+42.0)
Increase mounting panels to close up gaps between the panels based on current design.	+1.0
Decrease Guidance and Navigation System navigator control and display due to deleting the NVE-Vernier and NVE-Level Gain resistor modules.	-2.0
Increase event timer based on revised timer estimate.	+0.4
Decrease rotational manual control due to partial actual weights reported by Minneapolis Honeywell.	-0.8
Increase Controls and Displays electrical wiring and connectors based on current requirements reflected on released wiring diagrams.	+43.4
GUIDANCE AND NAVIGATION	(+19.0)
Increase Inertial Measurement Unit due to MIT reflecting actual weights of some parts.	+ 1.2
Increase Guidance and Navigation NAA cabling and connectors based on current requirements reflected on released wiring diagrams.	+17.8
STABILIZATION AND CONTROL	(+39.0)
Increase Stabilization and Control wiring and connectors based on current requirements reflected on released wiring diagrams.	+39.0

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COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

ELECTRICAL POWER	(+34.0)
Decrease batteries per latest Eagle-Pitcher weight breakdown.	-1.2
Increase energy source system due to the addition of the requirement for a bettery ventline and control assembly.	+1.5
Decrease main battery charger due to a weight reduction per the latest information from EDS.	-1.0
Delete PLSS battery charging system due to an increase in the PLSS battery voltage to 28 volts. Charging may now be accomplished with the main battery charger.	-1.0
Decrease A-C power box assembly based on revised estimates of the sensor unit diodes and resistors per prereleased drawings.	-1.4
Increase lower equipment bay motor switches due to revised estimate based on current procurement specifications.	+0.3
Increase terminal distribution panel based on calculation of released drawings.	+0.6
Increase power distribution electrical wiring and connectors based on current requirements reflected on release wiring diagrams.	+20.7
Increase right hand and left hand circuit breaker panels due to calculation of associated wiring required to connect up the panels.	+1.5
Increase umbilical based on current wiring requirements adding an additional umbilical and increasing the number of pins in the existing umbilical.	+14.0

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COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

ENVIRONMENTAL CONTROL		(-9.0)
Increase pressure suit circuit due to the following:		+11.4
Increase in AiResearch components due to the addition of a mechanical override to the return air check valve, and a sintered filter with a delta pressure switch to provide warning of a malfunction in the ECS water separator accumulator units.	+2.2	
Increase in ducting, clamps, and connectors due to transferring plumbing and supports from the water supply system and common supports.	+9.2	
Increase water-glycol circuit due to the following:		+1.2
Decrease in subcontractor vavles due to replacing solenoid shutoff valves with glycol shutoff valves.	-1.9	
Increase in glycol evaporator temperature control subsystem because the present subsystem can not provide required temperatures for satisfactory operation of IMU and suit circuit heat exchanger.	+4.9	
Decrease in plumbing due to calculation of drawings reflecting portion of plumbing below shaped charge.	-1.8	
Increase oxygen supply system due to the following:		+2.8
Increase in subcontractor valves due to updating the current AiResearch procurement specification.	+0.3	
Decrease in plumbing based on detail drawing changes.	-0.5	
Addition of re-entry backup oxygen system required due to the deletion of remaining PLSS.	+3.0	

[redacted]

COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

ENVIRONMENTAL CONTROL (Continued)		
Decrease water supply system due to the following:		-9.6
Increase in subcontractor components due to updating the current AiResearch procurement specification.	+1.0	
Decrease in plumbing due to transferring ducting clamps and connectors to the pressure suit system circuit.	-8.6	
Decrease of water separator accummulator warning system due to AiResearch adding this responsibility to their components.	-2.0	
Increase subcontractor common brackets, plumbing and wiring due to updating the current AiResearch procurement specification.		+1.0
Decrease subcontractor common instrumentation due to incorporating calculated values in lieu of estimated.		-1.9
Decrease supports due to transferring the responsibility of a portion of the supports to the pressure suit circuit.		-1.0
Decrease electrical wiring and connectors based on current requirements reflected on released wiring diagrams.		-12.9
EARTH LANDING SYSTEM		(+36.0)
Increase drogue chute system due to addition of a strap to the pack assembly and incorporation of the actual weight for the dorgue mortar cover.		+0.9
Decrease main chute cluster due to recalculation of cordage and the elimination of a portion of the riser protectors.		-1.3
Increase pilot chute system due to actual weight of mortar tube and cover in lieu of calculated weight.		+0.7

[redacted]

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COMMAND MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

EARTH LANDING SYSTEM (Continued)

Decrease sequencer control due to calculation of the redesigned "two box" units reflecting a reduction in relays and switches.	-4.4
Add a crushable energy absorbing structure in the aft equipment bay in the impact area due to incorporation of the "tumbling concept" changing the main parachute harness to a two leg attach configuration.	+40.1
TOTAL COMMAND MODULE CURRENT AIRFRAME WEIGHT EMPTY CHANGES	+394.0

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COMMAND MODULE

CURRENT AIRFRAME USEFUL LOAD CHANGES

CREW SYSTEMS	(-43.0)
Delete the remaining portable life support system from Airframe 011 based on NASA TWX W8977A approving this change.	-42.0
Decrease the waste management system based on calculations of current drawings.	-1.0
ENVIRONMENTAL CONTROL	(-6.0)
Increase containers for LiOH due to calculation of current drawings.	+ 0.3
Increase re-entry oxygen due to added requirement for an oxygen bottle needed due to deletion of the portable life support system.	+1.0
Delete PLSS water based on new water time curves indicating that enough water is supplied by the fuel cells that this item can be removed.	-6.8
Decrease earth orbit cooling water based on new water time curves.	-0.5
TOTAL COMMAND MODULE CURRENT AIRFRAME USEFUL LOAD CHANGES	-49.0

[redacted]

SERVICE MODULE WEIGHT STATUS

ITEM	PREVIOUS AFRM 011 STATUS 1-1-64	CHANGE TO CURRENT AFRM	CURRENT AFRM 011 WEIGHT 2-1-64	ESTIMATED CHANGES TO LOR	CURRENT LOR WEIGHT 2-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
Structure	2250	-5	2245	+40	2285	11	74	15
Electronics	181	+42	223	+58	281	71	29	
Reaction Control	580		580		580	61	39	
Electrical Power	1384	+13	1397	-8	1389	12	40	48
Environmental Control	87	+5	92		92	20	79	1
Propulsion System	(3038)		(3038)		(3038)			
Engine Installation	715		715		715	82	18	
Propulsion System	2323		2323		2323	13	87	
WEIGHT EMPTY	7520	+55	7575	+90	7665	25	62	13
RCS Propellant	838		838		838		100	
Electrical Power Super. Fluids	503		503		503		100	
Environmental Contr. Super. Fluids	208		208		208		100	
Main Propulsion Helium	99		99		99		100	
Main Propellant Residuals	(582)		(582)		(582)		100	
Trapped - System	225		225		225			
Trapped - Engine	67		67		67			
Mixture Ratio Tolerance	100		100		100			
Loading Tolerance	190		190		190			
BURNOUT WEIGHT	9750	+55	9805	+90	9895	19	71	10
Main Propellant	-		-		37985		100	
GROSS WEIGHT	-		-		47830	4	94	2

SERVICE MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

STRUCTURE	(-5.0)
Decrease honeycomb panel due to adding a cut out for the EPS fuel cell radiator resizing.	-5.0
ELECTRONICS	(+42.0)
Increase electrical provisions, wiring and connectors based on current measurement requirements reflected on released drawings.	+42.0
ELECTRICAL POWER	(+13.0)
Decrease fuel cell power pack based on current Pratt and Whitney report reflecting changes due to closer manufacturing control of electrode filling and weight status changes of components from calculated to actual.	-15.0
Increase intermodular radiator plumbing due to the addition of a fuel cell flow sensor to provide an indication of the flow pressure.	+4.6
Decrease fuel cell attachments due to calculations based on prereleased drawings.	-0.9
Decrease electrical wiring and connectors based on current requirements reflected on released drawings.	-6.3
Increase the EPS fuel cell radiator due to resizing the radiator for deep space or Lunar Orbit Mission as the current effective radiator area is too small.	+13.6
Add a valve module control box to the cryogenic system due to current system requirements.	+5.3
Decrease fuel cell plumbing supports due to calculation of current drawing changes.	-3.1

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SERVICE MODULE

CURRENT AIRFRAME WEIGHT EMPTY CHANGES

ELECTRICAL POWER (Continued)	
Increase umbilical based on current wiring requirements adding an additional umbilical and increasing the number of pins in the existing umbilical.	+8.0
Increase power distribution electrical wiring and connectors based on current requirements reflected on released wiring diagrams.	+6.8
ENVIRONMENTAL CONTROL	(+5.0)
Increase water-glycol circuit subcontractor space radiator isolation and vent valve due to the addition of radio noise filters basedon AiResearch report.	+3.7
Increase water-glycol circuit plumbing and hardware due to calculation of current plumbing routing shown on released drawings.	+1.8
Decrease water supply system plumbing and hardware due to calculation of current drawing requirements.	-0.5
TOTAL SERVICE MODULE CURRENT AIRFRAME WEIGHT EMPTY CHANGES	+55.0

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[redacted]

LAUNCH ESCAPE SYSTEM

WEIGHT STATUS

ITEM	PREVIOUS AFRM 011 STATUS 1-1-64	CHANGE TO CURRENT AFRM	CURRENT AFRM 011 WEIGHT 2-1-64	ESTIMATED CHANGES TO LOR	CURRENT LOR WEIGHT 2-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
Structure	1031		1031		1031	9	75	16
Electrical System	101	+1	102		102	100		
Propulsion System								
Main Thrust	4767		4767		4767	40	60	
Jettison	434		434		434			100
Jettison Motor Skirt	92		92		92			100
Pitch Control	47		47		47	60	40	
Separation Provisions	49		49		49	61	39	
C/M Boost Prot. Cover				+175	175	100		
LES - NO BALLAST	6521	+1	6522	+175	6697	35	55	10
BALLAST	574	+69	643	-80	563	100		
TOTAL L.E.S.	7095	+70	7165	+95	7260	41	50	9

[redacted]

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LAUNCH ESCAPE SYSTEM

CURRENT AIRFRAME CHANGES

BALLAST	(+69)
Increase ballast consistent with current Command Module and LES balance requirements.	+69
ELECTRICAL	(+1)
Increase electrical provision due to redesign of sequencer mounting brackets.	+1
TOTAL LAUNCH ESCAPE SYSTEM CURRENT AIRFRAME WEIGHT CHANGES	+70

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ADAPTER

WEIGHT STATUS

ITEM	PREVIOUS AFRM 011 STATUS 1-1-64	CHANGE TO CURRENT AFRM	CURRENT AFRM 011 WEIGHT 2-1-64	ESTIMATED CHANGE TO LOR	CURRENT LOR WEIGHT 2-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
Structure	709		709	+2361	3070			
Electrical	20		20	+60	80			
Separation System	156		156	+94	250			
TOTAL ADAPTER	885		885	+2515	3400	100		

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COMMAND MODULE

CURRENT LOR WEIGHT EMPTY CHANGES

STRUCTURE	(-71)
Eliminate the heat shield substructure face sheet pads (scar weight) provided on the first few spacecrafts for designs that were not consummated (strakes, plugs, vents, etc.).	-26
Analyze structure design in detail based on a refinement of loading conditions, as the original design was accomplished on an extremely tight schedule utilizing a minimum of loads and equipment information.	-40
Incorporate a boost protection cover over the Command Module nose to be jettisoned with the Launch Escape System tower. This would allow the ablative material thickness on the nose to be reduced.	-30
Reduce the spacecraft temperature criteria from 250°F to 200°F. A saving of approximately one pound of ablative material can be removed for every degree reduction at start of entry.	-50
Refine secondary structure design by additional machining of extrusions utilized in coldplate closeouts, alternate materials, and a reduction of supports for scientific equipment.	-60
Reduce heat shield window glass thickness from 0.70 inch to 0.55 inch based on a more detailed thermal and structural analysis.	-10
Decrease umbilical installation structure due to removing the added umbilical required for airframe instrumentation as the LOR wiring requirements have not been defined at this time.	-5
Add LEM docking provisions for the LOR mission.	+150
COMMUNICATIONS	(-9)
Decrease electrical wiring due to utilizing thin wall teflon installation where possible and reducing wire gage based on electrical load analysis.	-9

COMMAND MODULE

CURRENT LOR WEIGHT EMPTY CHANGES

INSTRUMENTATION	(-413)
Delete instrumentation required for flight qualification.	-305
Decrease electrical wiring due to utilizing thin wall teflon insulation where possible, reducing wire gage based on electrical load analysis and reducing instrumentation wiring by utilizing unshielded wire where possible.	-108
CONTROLS AND DISPLAYS	(-27)
Reduce weight of displays by utilizing lamps in lieu of the barometric pressure indicator and by sharing cryogenic pressure and quantity readouts between the hydrogen and oxygen requirements.	-4
Delete the self-test capability of the SCS displays.	-2
Delete tail-off switch from delta V indicator.	-1
Delete present reaction jet solenoid power switching relays from the SCS mode select panel. Utilize a manual switch and circuit breakers for reaction jet solenoid power control.	-2
Replace roll attitude error needle servo drive with galvanometer movement.	-1
Add rendezvous radar panel required for LOR mission.	+13
Delete console interface connectors resulting in some complications in manufacturing and repair of console.	-9
Decrease electrical wiring due to utilizing thin wall teflon insulation where possible and reducing wire gage based on electrical load analysis.	-21
GUIDANCE AND NAVIGATION	(-10)
Decrease electrical wiring due to utilizing thin wall teflon insulation where possible and reducing wire gage based on electrical load analysis.	-10

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COMMAND MODULE

CURRENT LOR WEIGHT EMPTY CHANGES

STABILIZATION AND CONTROL	(-26)
Remove all elapsed time indicators prior to flight.	-1
Utilize partial potting in low dissipation ECA modules.	-5
Reduce total length of ECA package. Packages are presently designed to include growth capabilities.	-3
Delete multiple monitor relays in DC amplifiers.	-1
Decrease electrical wiring due to utilizing thin wall teflon insulation where possible and reducing wire gage based on electrical load analysis.	-16
ELECTRICAL POWER	(-14)
Decrease umbilical due to deleting extra umbilical added on early airframes as the LOR wiring requirements have not been defined at this time.	-14
ENVIRONMENTAL CONTROL	(-7)
Utilize a combined tank with separate compartments for waste water and potable water.	-4
Delete re-entry backup oxygen system as the LOR vehicle has the requirement to carry one PLSS which may be utilized for back-up.	-3
TOTAL COMMAND MODULE CURRENT LOR WEIGHT EMPTY CHANGES	-577

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[redacted]

COMMAND MODULE

CURRENT LOR USEFUL LOAD CHANGES

CREW SYSTEMS	(+33)
Reduce life rafts due to design refinement utilizing higher strength to weight ratio materials.	-9
Add one portable life support system to the LOR vehicle as the requirement for this still exists.	+42
ENVIRONMENTAL CONTROL	(-1)
Delete re-entry oxygen required for airframes that do not carry a portable life support system.	-1
SCIENTIFIC EQUIPMENT	(+250)
Add scientific equipment based on current LOR mission requirements.	+250
TOTAL COMMAND MODULE CURRENT LOR USEFUL LOAD CHANGES	+282

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SERVICE MODULE

CURRENT LOR WEIGHT EMPTY CHANGES

STRUCTURE	(+40)
Add structural beef-up required to support the rendezvous radar equipment.	+40
ELECTRONICS	(+58)
Add rendezvous radar equipment consistent with the LOR requirements.	+120
Decrease electrical wiring due to utilizing thin wall teflon insulation where possible and reducing wire gage based on electrical load analysis.	-62
ELECTRICAL POWER	(-8)
Decrease umbilical due to deleting extra umbilical added on early airframes as the LOR wiring requirements have not been defined at this time.	-8
TOTAL SERVICE MODULE CURRENT LOR WEIGHT EMPTY CHANGES	+90

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LAUNCH ESCAPE SYSTEM

CURRENT LOR WEIGHT CHANGES

STRUCTURE	(+175)
Add a boost heat shield for protection of the forward compartment during boost heating. The addition of the boost heat shield reduces the forward compartment heat shield ablative thickness and lightens the injected spacecraft weight.	+175
BALLAST	(-80)
Decrease ballast consistent with current Command Module LES balance requirements.	-80
TOTAL LAUNCH ESCAPE SYSTEM CURRENT LOR WEIGHT CHANGES	+95

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[redacted]

ADAPTER

CURRENT LOR WEIGHT CHANGES

Utilize the S-IV B Adapter consistent with the current LOR mission requirements in lieu of the S-IV Airframe 011 Adapter. +2515

[redacted]

WEIGHT HISTORY COMMENTS

LAUNCH ESCAPE SYSTEM

The design goal established for the LES is 6,300 pounds, excluding ballast. This weight was based on the September 1962 status weight of 6,600 pounds, including the necessary ballast to provide currently determined aerodynamic stability to prevent tumbling.

The original design goal of 5,900 pounds, as reported in the June status, SID 62-99-5, was based on an attitude controlled configuration. The current configuration weight includes a pitch motor and ballast not included in the original target weight.

COMMAND MODULE

The design goal established for the Command Module is 8,500 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes.

The original design goal weight of 8,340 pounds, as reported in the June status, SID 62-99-5, did not include the proposed increases nor the Category I reductions presented in the July briefing and incorporated in the July Status Report.

SERVICE MODULE

The design goal established for the Service Module less usable propellant is 11,000 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes. This configuration is sized for 45,000 pounds usable propellant for the 25,000 pound LEM.

The original design goal weight of 8,595 for the burnout condition was based on a lunar configuration sized for 31,000 pounds usable propellant.

[redacted]

WEIGHT HISTORY

COMMAND MODULE

	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 2-1-64
Structure	3824	+277	4101
Crew Systems	530		530
Communication	330	+ 33	363
Instrumentation	173	+ 7	180
Controls & Displays	261	+ 13	274
Guidance & Navigation	261	+162	423
Stabilization & Control	181		181
Reaction Control	195		195
Electrical Power	390	+9	399
Environmental Control	235	-11	224
Earth Landing	610		610
WEIGHT EMPTY	6990	+490	7480
Crew	528		528
Suits & Personal Equipment	304	-8	296
Food & Containers	90		90
Reaction Control Propellant	210		210
Environmental Control Fluids	128		128
Scientific Payload	250		250
GROSS WEIGHT	8500	+482	8982

[redacted]

[redacted]

COMMAND MODULE WEIGHT HISTORY

WEIGHT EMPTY AUTHORIZED CHANGES

STRUCTURE	(+277)
Change parachute attach to a two leg configuration for incorporation of the "Tumbling Concept" at earth impact attenuation. (CCA No. 93)	+125
Delete the extendable heat shield window covers and replace current windows with high temperature glass consisting of (3) parallel glass panes. (CCA No. 105)	+2
Add LEM docking provisions for LOR.	+150
COMMUNICATIONS	(+33)
Add a spacecraft up-data link for the purpose of providing current GOSS data within the spacecraft for display and comparison with the on-board computed data. (CCA No. 54)	+35
Change the present two speed data storage to a three speed machine to provide fast dump of data. (CCA No. 59)	-2
INSTRUMENTATION	(+7)
Increase the PCM output bit rate from 31,000 to 51,200 bit/sec. This change was originally considered to have negligible weight affect but has henceforth been reported by Collins to cause a seven pound increase. (CCA No. 44)	+7
CONTROLS & DISPLAYS	(+13)
Furnish and install a clock timer panel at the navigation station lower equipment bay. (CCA No. 84)	+2
Decrease G & N navigation controls coded to controls and displays per MIT status.	-2
Add rendezvous radar for LOR.	+13

[redacted]

[redacted]

COMMAND MODULE WEIGHT HISTORY

WEIGHT EMPTY AUTHORIZED CHANGES

GUIDANCE & NAVIGATION	(+162)
Increase the Guidance and Navigation per recent weight report from MIT. Since NAA does not have weight control responsibility for the MIT design, the weight changes in their Weight and Balance Report will be considered as authorized changes.	+162
ELECTRICAL POWER	(+9)
Add two batteries to provide a source of power, separate from the primary D.C. power, to initiate pyrotechnic devices. (CCA No. 28)	+ 10
Delete automatic LES tower ejection function from flight sequencer for normal missions. (CCA No. 91)	-1
ENVIRONMENTAL CONTROL	(-11)
Add a CO_2 sensor to the ECS as a part of the ECS operational instrumentation. (CCA No. 43)	+3
Add a surge tank to ECS and delete entry oxygen supply to provide early mission emergency gas flows. (CCA No. 52)	-7
Deletion of regenerative heat exchanger from the ECS heat exchanger package. (CCA No. 63)	-7
Decrease pressure suit gas flow requirement for ventilation flow from 12 CFM to 10 CFM. (CCA No. 123)	+1
TOTAL COMMAND MODULE WEIGHT EMPTY CHANGES	+490

[redacted]

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COMMAND MODULE WEIGHT HISTORY

USEFUL LOAD AUTHORIZED CHANGES

SUITS & PERSONAL EQUIPMENT		(-8)
Change the following GFE (NASA) responsibility items:		
Increase personal radiation dosimeters per NASA Crew Systems Meeting Number 19, Action Item Number 6.	+10	
Increase PLSS per Hamilton Standard status.	+36	
Delete initial charge water for coolant, from PLSS, as this item is now carried in the potable water tank.	-5	
Delete one PLSS consistent with requirements for LOR mission.	-48	
Delete primary oxygen from remaining PLSS.	-1	
TOTAL COMMAND MODULE USEFUL LOAD CHANGES		-8

[redacted]

WEIGHT HISTORY

SERVICE MODULE

	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 2-1-64
Structure	3203	+40	3243
Electronics	145	+120	265
Reaction Control	737		737
Electrical Power	1203		1203
Environmental Control	250		250
Propulsion System			
Engine Installation	606		606
Propellant System	2456		2456
WEIGHT EMPTY	8600	+160	8760
Usable RCS Propellant	611		611
Usable Fuel Cell Reactants	479		479
Environmental Control Fluids	193		193
Main Propulsion Helium	139		139
Main Prop. Residuals	900		900
Unusable RCS Propellant	61		61
Unusable Fuel Cell Reactants	17		17
BURNOUT WEIGHT	11000	+160	11160
Main Propellant	45000		45000
GROSS WEIGHT	56000		56160

[redacted]

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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

STRUCTURE	(+193)
Increase ablator consistent with current AVCO status. NAA is currently studying AVCO's ablator thicknesses and densities versus new heating rates.	+168
Increase honeycomb bonding due to a change in adhesive bonding specification for the Apollo spacecraft requiring increases in the bonding thicknesses in the splicing areas.	+25
CREW SYSTEMS	(-107)
Change in crew and metabolic criteria based on astronaut data and new NASA metabolic rates.	
Crew	-49
Food and Containers	-12
Increase constant wear garments per Space Suit Interface Meeting	+5
Delete requirement for the PLSS as there is no extra vehicular missions planned from the Command Module.	-45
Decrease mission duration from 14 days to 8 days:	
Food and Containers	-26
Chemical Disinfectant	-5
Increase survival kit based on latest estimates	+25
COMMUNICATION & INSTRUMENTATION	(-53)
Repackage PCM components	-18
Utilize Conic Corporation VHF/FM and unmodular HF	-8
Delete PCM provision for flight qualification instrumentation growth.	-10
Utilize Rantec Multiplexer	-6
Decrease spares per reliability studies.	-11

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[redacted]

POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

STABILIZATION & CONTROL	(-34)
Utilize magnesium in lieu of aluminum on ECA base plates.	-25
Change internal package connectors from Amphenol to Cannon based on recent connector optimization study.	-9
GUIDANCE & NAVIGATION	(-100)
Incorporate simplified G&N system for Block II vehicles.	-100
REACTION CONTROL	(+46)
Add a dual switching control box required to activate C/M RCS engines after S/M separation.	+21
Increase RCS engine weight per Rocketdyne status.	+25
ELECTRICAL POWER SYSTEM	(+71)
Increase electrical Command Module to Service Module umbilical consistent with potential intermodular wiring requirement.	+85
Decrease inverters due to redesign of power transistors.	-14
ENVIRONMENTAL CONTROL SYSTEM	(-70)
Reduce lithium hydroxide and container per change in Crew and Metabolic criteria based on astronaut data and new NASA metabolic rates.	-18
Reduce quantity requirements of lithium hydroxide due to mission duration decrease from 14 days to 8 days.	-47
Add re-entry oxygen required due to deletion of PLSS.	+4
Delete two lithium hydroxide charges by raising the maximum allowable CO_2 content.	-9
EARTH LANDING SYSTEM	(-80)
Incorporate Block II configuration reducing main parachute design "q" from 64 to 45-50 "q" thereby reducing design limit load from 24K to 18K.	-80

[redacted]

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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

SCIENTIFIC EQUIPMENT	(-170)
Remove from Lower Equipment Bay	-35
Remove from Right Hand Equipment Bay	-135
TOTAL POTENTIAL WEIGHT CHANGES - COMMAND MODULE	-304

[redacted]

POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

SERVICE MODULE

STRUCTURE	(+100)
Increase honeycomb bonding due to a change in adhesive bonding specification for the Apollo spacecraft requiring increases in the bonding thicknesses in the splicing areas.	+100
ELECTRICAL POWER	(-219)
Reduce H_2 for 8 day mission in lieu of 14 day.	-12
Reduce O_2 for 8 day mission in lieu of 14 day.	-280
Decrease in Fuel Cell Power System based on folded fuel cell design.	-50
Increase fuel cell reactants for 660 kw-hrs.	+58
Increase electrical Command Module to Service Module umbilical consistent with potential intermodular wiring requirement.	+65
ENVIRONMENTAL CONTROL	(+217)
Addition of S/M temperature control system to provide required heating or cooling to the Reaction Control System and Service Propulsion Systems.	+217
TOTAL POTENTIAL WEIGHT CHANGES - SERVICE MODULE	+102

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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

ADAPTER-LEM

Increase honeycomb bonding due to a change in adhesive bonding specification for the Apollo spacecraft requiring increases in the bonding thicknesses in the splicing area.	+200

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

SUMMARY

ITEM		CURRENT WEIGHT 2-1-64
WEIGHT EMPTY		8452
Structure	4680	
Crew Systems	387	
Communications	352	
Instrumentation	256	
Controls & Displays	300	
Guidance & Navigation	431	
Stabilization & Control	227	
Reaction Control	327	
Electrical Power	519	
Environmental Control	281	
Earth Landing	692	
USEFUL LOAD		1538
Crew Systems	868	
Reaction Control	270	
Environmental Control	150	
Scientific Payload	250	
GROSS WEIGHT		9990

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DETAIL WEIGHT STATEMENT
COMMAND MODULE
STRUCTURE

ITEM		CURRENT WEIGHT 2-1-64
STRUCTURE		
Inner Structure		(1060)
Forward Section		207
Honeycomb	63	
Frames, Rings and Hatches	57	
Fittings and Attachments	87	
Center Section		664
Honeycomb Panels	196	
Longerons, Frames and Rings	263	
Windows and Hatches	104	
Fittings and Attachments	101	
Aft Section		189
Honeycomb Panel	110	
Ring	79	
Secondary Structure		(561)
RH Equipment Bay and Coldplates		80
LH Equipment Bay		80
Fwd. LH Equipment Bay		20
Fwd. RH Equipment Bay and Coldplates		19
Main Display Panel and Coldplates		59
Lower Equipment Bay and Coldplates		196
Aft Equipment Bay		62
Crew Area		5
Heat Shield Equipment Area		40
Heat Shield Substructure		(1419)
Forward Section		195
Honeycomb Panels	109	
Frames and Rings	35	
Fittings and Mechanism	51	
Center Section		698
Honeycomb Panels	246	
Frames and Rings	102	
Doors and Covers	185	
Fittings, Mechanism and Attachments	141	
Air Vent	24	
Aft Section		526
Honeycomb Panels	350	
Frames and Rings	47	
Fittings and Attachments	81	
Toroidal Assembly	48	
Ablation Material		(1273)
Forward Section		116
Center Section		529
Aft Section		628
Insulation		(195)
Separation Provisions and Attachments		(22)
LEM Docking		(150)
TOTAL STRUCTURE		4680

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

CREW SYSTEMS

ITEM	CURRENT WEIGHT 2-1-64
CREW SYSTEMS	
Crew Couch Support and Restraint System	26.0
Waste Management	2.1
Egress Accessories - Hatch	3.0
Case Assembly - Map and Manual	2.0
Shelf Assy. - Work/Food Preparation	1.9
Food Storage Boxes	5.0
Structural Seats	260.0
Couch Supports and Attachments	87.0
TOTAL CREW SYSTEMS	387.0

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[redacted]

DETAIL WEIGHT STATEMENT

COMMAND MODULE

COMMUNICATIONS

ITEM	CURRENT WEIGHT 2-1-64
COMMUNICATIONS	
Lower Bay	(258.7)
C-Band Transponder	20.8
Unified S-Band	30.9
S-Band Power Amplifier	17.5
VHF-FM Transmitter/HF Transceiver	15.2
VHF AM Trans. -Rec/VHF Rec. Bea.	15.1
Multiplexer	11.0
Spares	19.0
Signal Conditioner	40.0
Recorder	25.4
Audio Center	8.0
Premodulation Processor	13.8
Central Timing Equipment	8.0
Up Data Link and Provisions	25.0
VHF-HF Diplexer	1.7
VHF-UHF Diplexer	1.5
S-Band P.A. Spare Traveling Wave Tube	1.3
S-Band P.A. Spare Power Supply	4.5
Remote Equipment	(57.3)
VHF-HF Recovery Antenna & Transmission	11.4
C-Band Antenna & Transmission	11.7
2-KMC High Gain Antenna and Transmission	4.4
VHF-2 KMC Omni Ant., Trans. & Instl. Prov.	29.8
Electrical Provisions	(36.0)
Electrical Wiring	23.2
Data Distribution Panel	1.5
Coax	5.2
Connectors	6.1
TOTAL COMMUNICATIONS	352.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

INSTRUMENTATION

ITEM	CURRENT WEIGHT 2-1-64
INSTRUMENTATION	
Lower Equipment Bay	(58.7)
PCM Unit No. 1	26.6
PCM Unit No. 2	21.1
Nuclear Radiation Detection Equipment	11.0
Remote Equipment	(47.0)
Sensors	35.0
Nuclear Radiation Detection Provisions	6.0
TV Camera	4.5
TV Viewfinder	1.5
Right Hand Bay Forward	(36.1)
Inflight Test System	
Comparators and Power Supply	16.5
Lamps	1.9
Switches	1.5
Meter	1.0
Chassis	9.1
Harness	4.1
Access Cable	2.0
Electrical Provisions	(114.2)
Inflight Test Electrical Provisions	22.0
Data Distribution Panel	2.2
Instrumentation Electrical Provisions	90.0
TOTAL INSTRUMENTATION	256.0

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DETAIL WEIGHT STATEMENT
COMMAND MODULE
CONTROLS AND DISPLAYS

ITEM	CURRENT WEIGHT 2-1-64
MAIN DISPLAY PANEL	
Main Display Panel Control Station	(57.8)
SCS Mode Select	3.2
Delta Velocity	2.2
Flight Director Attitude Indicator	10.0
Attitude Set and Gimbal Position Display	4.8
SPS Gimbal Actuator	.5
Entry Monitoring Indicator	15.0
Launch Vehicle Emergency Detection System C-1	4.7
Master Caution and Abort Lt.	.3
IFTS Switch	.1
Barometric Indicator Light	.1
Event Timer	1.5
Mounting Panels	2.4
Rendezvous Radar	13.0
Main Display Panel Center Station	(61.3)
Audio Panel	1.2
Abort Light	.2
Reaction Control	11.2
GMT Readout	.8
ECS Gages and Controls	6.6
Crew Safety Controls	1.6
High Gain Antenna Control	2.6
G & N Computer Keyboard	15.0
Radiation Displays	3.0
Cryogenic	4.2
Caution and Warning Display	4.8
Mounting Panels	10.1
Main Display Panel System Management Station	(31.5)
Communications Control Panel	4.0
Master Caution Lights	.2
Power Distribution	6.1
Fuel Cells Controls	4.7
Service Propulsion	8.9
IFTS Switch	.1
Oxygen Warning	.1
Mounting Panels	7.4
Main Display Panel RH Console	(10.5)
Bus Switches	5.7
Audio Panel	1.2
Lighting Control	1.6
Mounting Panels	2.0
Main Display Panel LH Console	(7.9)
Mission Sequence Controls	1.0
Lighting Control	1.6
Audio Panel	1.2
SCS Power Control	2.2
Mounting Panels	1.9
TOTAL MAIN DISPLAY PANEL (To be brought forward)	169.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

CONTROLS AND DISPLAYS

ITEM		CURRENT WEIGHT 2-1-64
REMOTE EQUIPMENT		
Lower Equipment Bay		(48.0)
Lighting Control Panel		1.2
G & N Controls and Displays		46.8
Map and Data Viewer	8.5	
Display and Control - Navigation	23.3	
Display and Control - Computer	15.0	
Left Hand Forward Equipment Bay		(3.0)
Clock		.8
Event Timer		2.0
Mounting Panel		.2
Crew Area Controls		(19.7)
Manual Control - Rotation		11.3
Manual Control - Translational		8.4
Caution and Warning		(16.5)
Detector		14.0
Spares		2.5
Electrical Provisions		(43.8)
Electrical Wiring		43.1
SCS/G & N Display Junction Box		.7
TOTAL REMOTE EQUIPMENT		131.0
TOTAL MAIN DISPLAY PANEL		169.0
TOTAL CONTROLS AND DISPLAYS		300.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

GUIDANCE & NAVIGATION

ITEM	CURRENT WEIGHT 2-1-64
GUIDANCE AND NAVIGATION	
Electronic Equipment	(270.9)
Inertial Measurement	60.2
Navigation Base	27.2
Computer & Spare Tray	70.0
Computer Stored Spares	25.0
Power Servo Assembly	59.4
Coupling Display Unit	16.5
Bellows Assembly	12.6
Optical Equipment	(45.8)
Sextant	12.0
Telescope	9.0
Optical Base	21.0
Optical Eyepieces	3.8
Loose Stored Items	(45.8)
Film Cartridges (4)	3.0
Computer Loose Spares	17.3
Power Servo Assembly Loose Spares	16.7
CDU Spare Gear Box	3.0
Spare Relay & Diode Module	.3
Eye Relief Eyepiece	1.5
Horizon Photometer	4.0
Electrical Provisions	(67.5)
Cabling MIT	43.2
Cabling NAA	24.3
Coolant Hoses	(1.0)
TOTAL GUIDANCE AND NAVIGATION	431.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

STABILIZATION AND CONTROL

ITEM	CURRENT WEIGHT 2-1-64
STABILIZATION AND CONTROL	
Lower Equipment Bay	(186.2)
Rate Gyro Package	7.5
Body Mounted Gyro Package	12.8
Electronic Control Package - Pitch	29.0
Electronic Control Package - Roll	28.3
Electronic Control Package - Yaw	28.2
Electronic Control Package - Auxiliary	29.2
Display/BMAG ECA Package	36.7
Spare Gyro - BMAG (2)	2.0
Spare Gyro - Rate	.5
Spare Plug-In Module	12.0
Electrical Provisions	(40.8)
Wiring, etc.	40.2
SCS Power Junction Box	.6
TOTAL STABILIZATION AND CONTROL	227.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

REACTION CONTROL SYSTEM

ITEM		CURRENT WEIGHT 2-1-64
REACTION CONTROL SYSTEM		
Propellant System		(74.6)
Oxidizer System		37.2
Tanks & Expulsion Devices	15.0	
Plumbing, Fittings & Insulation	11.4	
Valves & Regulators	10.3	
Sensors	.5	
Fuel System		37.4
Tanks & Expulsion Devices	15.2	
Plumbing, Fittings & Insulation	11.4	
Valves & Regulators	10.3	
Sensors	.5	
Pressure System		(55.4)
Tanks (4500 psi)		9.5
Plumbing, Fittings & Insulation		4.8
Valves & Regulators		38.6
Sensors		2.5
Engine System		(141.6)
Engines		99.6
Nozzle Extension		42.0
Electrical Provisions		(23.0)
Dumping System		(32.4)
Valves & Supports		13.0
Controls & Electrical Provisions		12.0
Plumbing & Fittings		5.0
Miscellaneous		2.4
TOTAL REACTION CONTROL SYSTEM		327.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

ELECTRICAL POWER

ITEM	CURRENT WEIGHT 2-1-64
ELECTRICAL POWER	
Energy Source	(77.8)
Battery - Re-Entry (2)	44.2
Battery - Post Landing (1)	22.1
Battery - Pyrotechnic - Installation	10.0
Battery Vent System	1.5
Power Conversion	(121.0)
Inverter (3) & Control	117.0
Battery Charger & Controls	4.0
Power Distribution & Control	(115.5)
D-C Power Panel Assy	7.6
A-C Power Box Assy	10.5
Battery Circuit Breaker Panel	3.4
Lower Equipment Bay Panel	5.4
Terminal Distribution Panel (Bus)	9.6
Circuit Breaker Panel	4.7
Electrical Transmission (Wiring, Connectors, Cond., Sup.)	55.3
Ground Power Provisions	6.0
Power Control Panel Connectors	3.0
Installation Provisions	10.0
Electrical Common Utility	(204.7)
Electrical Transmission (Wiring, Conn., Cond., & Sup.)	87.7
Right Hand Circuit Breaker Panel	17.1
Left Hand Circuit Breaker Panel	10.9
Lighting Equipment	10.3
Lighting	5.0
Adapter Separation System	5.0
LES Separation System	3.5
S/M Pyrotechnic Initiation	3.0
Circuit Utilization Package	6.6
Sequencer	39.1
Installation Provisions	13.5
C/M to S/M Separation System Wiring & Hardware	3.0
TOTAL ELECTRICAL POWER	519.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

ENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT 2-1-64
ENVIRONMENTAL CONTROL SYSTEM	
Pressure Suit Circuit	(88.5)
Subcontractor Compressor, Heat Exchg., Val. & Cont.	70.8
Ducting, Conn., Clamps, & Compr. Sel. Sw.	15.7
CO_2 Sensor	2.0
Water-Glycol Circuit	(60.5)
Subcontractor Res., Evaporator, Pump, Val. & Cont.	31.4
Water-Glycol	18.4
Plumbing & Glycol Pump Sel. Sw.	10.7
Pressure & Temp. Control	(19.1)
Subcontractor Heat Exchg., Blower, Val. & Cont.	18.1
Ducting & Cabin Blower Sel. Sw.	1.0
Oxygen Supply System	(15.7)
Subcontractor Val. & Cont.	5.0
Plumbing	3.5
Oxygen Surge Tank	7.2
Water Supply System	(27.3)
Subcontractor Potable & Waste Tanks	24.2
Plumbing	3.1
Subcontractor Common Items	(24.9)
Brackets, Plumbing, Elect. Wiring	12.5
Instrumentation	12.4
Waste Management System	(18.8)
Supports	(11.7)
Electrical Provisions	(8.1)
Manual Controls - Push Pull	(3.6)
N_2 Purge System	(2.8)
TOTAL ENVIRONMENTAL CONTROL SYSTEM	281.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

EARTH LANDING SYSTEM

ITEM	CURRENT WEIGHT 2-1-64
EARTH LANDING SYSTEM	
Parachute System	(579.5)
Drogue Chute System	79.6
Main Cluster	416.4
Disconnect Main Cluster	3.1
Pilot Chute System	30.6
Sequence Control	7.8
Attach Provisions	42.0
Location Aids	(6.3)
Forward Heat Shield Release System	(51.1)
Drogue Disconnect Installation	(9.0)
Electrical Pyrotechnic Initiation Provisions	(6.0)
Crushable Honeycomb - Impact Attenuation	(40.1)
TOTAL EARTH LANDING SYSTEM	692.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

USEFUL LOAD

ITEM	CURRENT WEIGHT 2-1-64
CREW SYSTEMS	
Government Furnished Equipment	(144.0)
Pressure Garment Assembly (3)	79.2
Portable Life Support System (1)	42.0
Garments - Constant Wear	9.0
Biomedical Instrumentation	2.0
Personal Radiation Dosimeters	11.8
Crew (50, 70, 90 Percentile)	(528.0)
Food and Associated Equipment	(83.5)
Food	67.5
Food Containers	12.5
Food Mouthpiece - Personal	2.0
Water Delivery Assembly - Personal	1.5
Crew Accessories	(8.0)
Lap Board Assembly	2.0
Manual Set	3.0
Map Set	1.0
Logbook Assembly	1.0
Tool Set - Inflight Maintenance	1.0
Crew Equipment	(26.2)
Shoe Straps	2.0
Hose Assembly - Umbilical	17.9
Belt Assembly - Inflight Maintenance	1.0
Hose Assembly - Recharging, Backpack	2.8
Suit Electrical Umbilical and Wire	2.5
Waste Management	(2.5)
Medical Equipment	(12.1)
Personal Hygiene Equipment	(15.6)
Light Assembly - Portable	(3.0)
Provisions Assembly - Crew Survival	(42.1)
Personal Communications	(3.0)
TOTAL CREW SYSTEM (To be brought forward)	868.0

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DETAIL WEIGHT STATEMENT

COMMAND MODULE

USEFUL LOAD

ITEM		CURRENT WEIGHT 2-1-64
REACTION CONTROL		(270.0)
Usable Propellant		225.0
Residual Propellant		44.0
Trapped - System	30.8	
Mixture Ratio	2.7	
Expulsion Efficiency	7.8	
Loading Tolerance	2.7	
RCS Helium		1.0
ENVIRONMENTAL CONTROL		(150.0)
Lithium Hydroxide		112.0
Activated Charcoal		4.0
Containers for LiOH & Charcoal		12.8
Oxygen - Re-Entry		3.7
Water-Earth Orbit Cooling & Drinking		3.5
Water-Boost Cooling		4.0
Water-Emergency Re-Entry Cooling		6.0
Chemical Disinfectant		4.0
SCIENTIFIC EQUIPMENT		(250.0)
TOTAL This page		670.0
TOTAL CREW SYSTEM (Brought forward from Page)		868.0
TOTAL USEFUL LOAD		1538.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

SUMMARY

ITEM		CURRENT WEIGHT 2-1-64
WEIGHT EMPTY		7665
Structure	2285	
Electronics	281	
Reaction Control	580	
Electrical Power	1389	
Environmental Control	92	
Propulsion	3038	
USEFUL LOAD		2230
Reaction Control	838	
Electrical Power	503	
Environmental Control	208	
Propulsion	681	
BURNOUT WEIGHT		9895
MAIN PROPELLANT		37935
GROSS WEIGHT		47830

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

STRUCTURE

ITEM	CURRENT WEIGHT 2-1-64
STRUCTURE	
Basic Body Structure	(1611)
Honeycomb Panels	562
Frame and Rings	6
Access Doors	15
Fittings and Attach Parts	42
Radial Beams	373
Internal Partitions	25
Forward Bulkhead	161
Aft Bulkhead	305
RCS Panels	122
Secondary Structure	(185)
Tank Support Shelf	29
Engine Support Structure	54
Antenna Support Structure	50
Aft Heat Shield	52
Insulation	(299)
Separation Provisions and Attachments	(16)
Fairing - C/M to S/M	(144)
Miscellaneous	(30)
TOTAL STRUCTURE	2285

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

ELECTRONICS SUBSYSTEM

ITEM	CURRENT WEIGHT 2-1-64
ELECTRONICS SUBSYSTEM	
Communications	(51.0)
High Gain Antenna	
Antenna	12.2
Gimbals	12.0
Earth Sensor	4.8
Antenna Boom	7.0
Antenna Locking Provisions	3.0
Coax	8.0
Coax Connectors	1.0
Supports	1.0
Wiring	2.0
Instrumentation	(110.0)
Sensors	30.0
Electrical Provisions	75.0
Supports	5.0
Rendezvous Equipment	(82.4)
Radar Package	30.0
X-Band Dish Ant., Trans. & Sup.	17.8
Antenna Boom	10.0
Antenna Actuation Mechanism	10.0
Electrical Provisions	3.0
Supports & Cooling Provisions	9.6
Diplexer	2.0
Transponder Equipment	(37.6)
Transponder	10.0
X-Band Flush Mntd. Omni Ant. (3)	3.0
X-Band Trans. & Supports	12.6
X-Band Power Divider	1.0
Electrical Provisions	3.0
Supports & Cooling Provisions	6.0
Diplexer	2.0
TOTAL ELECTRONICS SUBSYSTEM	281.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

REACTION CONTROL

ITEM		CURRENT WEIGHT 2-1-64
REACTION CONTROL SYSTEM		
Propellant Systems		(161.4)
Oxidizer System		80.5
Tanks & Expulsion Devices	28.8	
Plumbing, Fittings & Insulation	8.5	
Valves & Regulators	12.0	
Sensors	3.0	
Supports	18.2	
Quantity Gaging	10.0	
Fuel System		80.9
Tanks & Expulsion Devices	29.2	
Plumbing, Fittings & Insulation	8.5	
Valves & Regulators	12.0	
Sensors	3.0	
Supports	18.2	
Quantity Gaging	10.0	
Pressure System		(128.0)
Tanks (4500 psi)		19.0
Plumbing, Fittings & Insulation		6.0
Valves & Regulators		76.0
Sensors		7.0
Supports		20.0
Engine System		(150.4)
Engines		70.4
Reflectors & Insulation		80.0
Structural Provisions		(80.0)
Electrical Provisions		(60.2)
TOTAL REACTION CONTROL SYSTEM		580.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

ELECTRICAL POWER

ITEM	CURRENT WEIGHT 2-1-64
ELECTRICAL POWER	
Fuel Cell Power System	(1195.9)
Fuel Cell Power Pack (Incl. Mount Instrumentation)	738.6
Intermodular - Radiator Plumbing	31.3
Fuel Cell Module Mount Attach	1.1
Fuel Cell H_2 System	
Subcontractor Components	153.2
Plumbing and Valves	5.5
Fuel Cell and ECS O_2 System	
Subcontractor Components	168.2
Plumbing and Valves and Supports	31.7
Water Glycol - Fuel Cell Heat Transfer System	7.0
Elect. Wiring - Supercritical Gas	3.7
Space Radiator (Outer Skin)	40.5
Fuel Cell Module Stabilization Webs	3.8
Fuel Cell Plumbing Supports	6.0
Valve Module Control Box (Cryogenic Gas)	5.3
Power Distribution	(77.6)
Electrical Transmission	46.8
Power Distribution Box	30.8
Electrical Common Utility	(115.5)
Electrical Transmission	41.0
Sequencer	28.0
Adapter Separation System	7.0
C/M to S/M Separation System	18.0
Pyrotechnic Initiation	12.0
Provisions	9.5
TOTAL ELECTRICAL POWER	1389.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

ENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT 2-1-64
ENVIRONMENTAL CONTROL SYSTEM	
Water-Glycol Circuit	(80.3)
Subcontractor Valves & Controls	9.7
Plumbing and Hardware	23.3
Water - Glycol	10.0
Space Radiator (Outer Skin)	37.3
Water Supply System	(6.6)
Plumbing and Hardware	6.6
Oxygen Supply System	(3.0)
Plumbing and Supports	3.0
Common Items	(2.1)
Supports	1.6
Subcontractor Miscellaneous Supports	.5
TOTAL ENVIRONMENTAL CONTROL SYSTEM	92.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

MAIN PROPULSION

ITEM		CURRENT WEIGHT 2-1-64
MAIN PROPULSION		
Propellant Systems		(1356.0)
Oxidizer System		759.3
Tanks & Doors	557.0	
Skirts	59.8	
Plumbing, Fittings & Insulation	53.0	
Valves	4.5	
Quantity Indication	25.5	
Mixture Ratio Control	14.0	
Supports - Plumbing & Equipment	45.5	
Fuel System		596.7
Tanks & Doors	458.0	
Skirts	33.2	
Plumbing, Fittings & Insulation	42.0	
Valves	4.5	
Quantity Indication	25.5	
Supports - Plumbing & Equipment	33.5	
Pressure System		(925.0)
Tanks (4400 psi)		784.0
Tanks Supports		30.0
Plumbing, Fittings & Insulation		24.0
Valves, Regulators & Heat Exchanger		49.0
Supports - Plumbing & Equipment		38.0
Engine System		(715.0)
Engine		690.0
Closeouts - Throat to S/M		25.0
Electrical Provisions		(42.0)
TOTAL MAIN PROPULSION SYSTEM		3038.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

USEFUL LOAD

ITEM			CURRENT WEIGHT 2-1-64
REACTION CONTROL			(838.0)
RCS Propellant			835.0
Usable		790.0	
Residual		45.0	
Trapped System	4.0		
Mixture Ratio	9.0		
Expulsion Efficiency	24.0		
Loading Tolerance	8.0		
RCS Helium			3.0
ELECTRICAL POWER (Normal Mission)			(503.0)
Hydrogen - Supercritical Gas			58.5
Usable (Electrochemical Incl. Tolerance)		46.0	
Unusable (Residual & Instrument Error)		3.2	
Emergency Provisions		4.7	
Expended (Leakage & Purge)		4.6	
Oxygen - Supercritical Gas			444.5
Usable (Electrochemical Incl. Tolerance		377.0	
Unusable (Residual & Instrument Error)		17.5	
Emergency Provisions		44.0	
Expended (Leakage & Purge)		6.0	
ENVIRONMENTAL CONTROL (Normal Mission)			(208.0)
Oxygen - Supercritical Gas			208.0
Usable (Metabolic)		76.5	
Unusable (Residual & Instrument Error)		9.1	
Emergency Provisions		25.3	
Expended (Leakage, LEM, PLSS, Repress.)		97.1	
PROPULSION			(681.0)
Main Propulsion Helium			99.0
Main Propellant Residuals			582.0
Trapped - System		225.0	
Trapped - Engine		67.0	
Mixture Ratio Tolerance		100.0	
Loading Tolerance		190.0	
TOTAL USEFUL LOAD (Less Main Propellant)			2230.0

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DETAIL WEIGHT STATEMENT

LAUNCH ESCAPE SYSTEM

SUMMARY

ITEM	CURRENT WEIGHT 2-1-64
LAUNCH ESCAPE SYSTEM	
Structure	(1031)
Tower Assy	316
Escape Motor Skirt	208
Pitch Motor Structure	162
Nose Cone and Ballast Support	113
Attaching Parts	9
Tower Insulation	198
Skirt Insulation	25
Separation Provisions	(49)
Ballast	(563)
Propulsion	(5340)
Escape Motor	4767
Jettison Motor	434
Jettison Motor Skirt	92
Pitch Control Motor	47
Electrical Power	(102)
C/M Boost Protection Cover	(175)
TOTAL LAUNCH ESCAPE SYSTEM	7260

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DETAIL WEIGHT STATEMENT

ADAPTER

SUMMARY

ITEM	CURRENT WEIGHT 2-1-64
ADAPTER	
Structure	(3330)
Basic Body Structure	
Honeycomb Panels	2237
Longerons	44
Frames & Rings	208
Access Doors	50
Fittings & Attachings Parts	50
Secondary Structure	
LEM Supports	36
Insulation	387
Separation Provisions & Attach	288
Miscellaneous	30
Electrical Provisions	(70)
TOTAL ADAPTER	3400

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